DynaFlame/DynaForce BMS Protocol (Modbus, Bacnet IP, Bacnet MSTP, LONWorks, Metasys N2) Installation Guide

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DynaFlame/DynaForce SOLA and BMS Protocols

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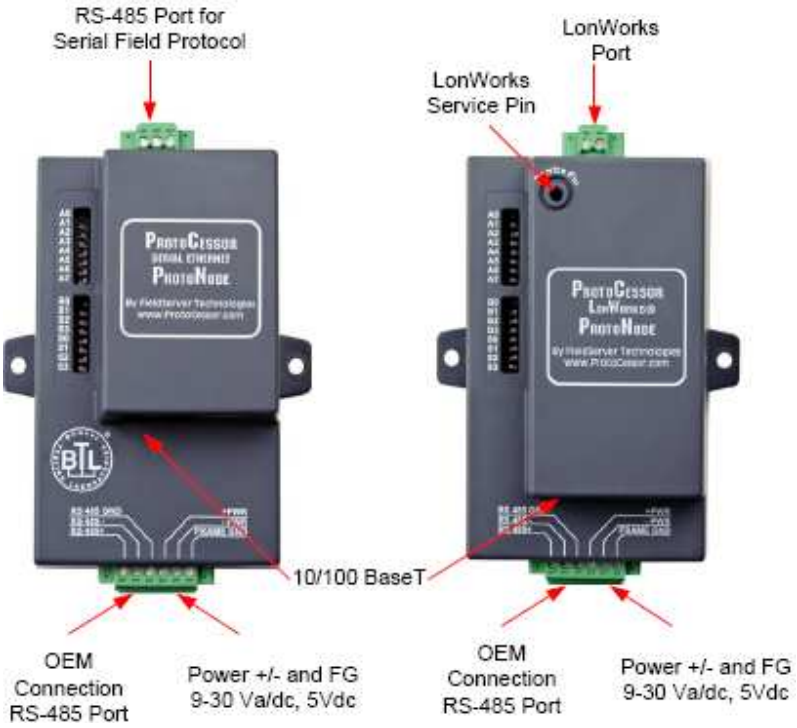
1.1 Bacnet/LONWorks/Metasys N2Setup through Protocessor Protonode RER/LER

Installation steps for the customer

1. Record the information about the unit See Section
2. Set the DIP switches
3. Connect up the Field and Host cable
4. Connect the power

1.2 Protonode RER and LER showing connection ports

Figure 1: Protonode Bacnet/ Metasys N2 RER (left) and Lonworks (LER)

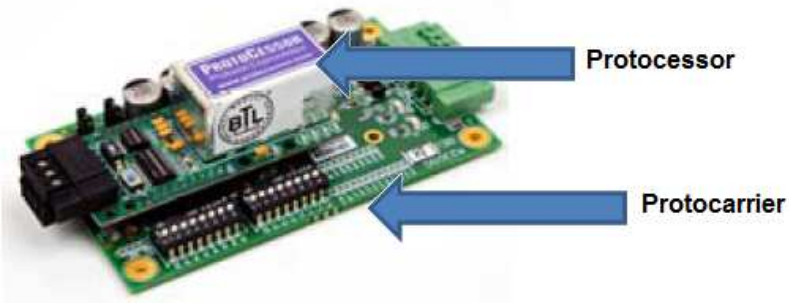


1.3 Record Identification Data

Each ProtoNode has a unique part number located on the underside of the unit. The number format is FPC-N3(4,5)-XXX-XXX-XXXX. This number should be recorded as it may be required for technical support.

1.4 Configure the DIP Switches

1.4.1 Setting the Protocol that is required on site.



Selecting the required Protocol

To configure the Protonode to match what is on site please follow the below chart identifying the dipswitch settings for the different configurations. For example, if the BMS requires communication over Bacnet IP and there are four boilers on site the technician would select Bacnet IP 4 Sola and configure the S0 – S3 dipswitches on the ProtoCarrier accordingly.

Power must be cycled after the dip switch settings have been adjusted in order for the changes to take effect

FPC-N34-103-122-0565 Dipswitch settings

ProtoCarrier Dipswitches				ProtoCessor Dipswitches								
S0	**S1**	**S2**	**S3**	**A1**	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**Profile**
Off	Off	Off	Off	Refer to 1.4.2 to set the Node/ID device Instance								BACnet IP 1 Sola
On	Off	Off	Off									BACnet IP 2 Sola
Off	On	Off	Off									BACnet IP 3 Sola
On	On	Off	Off									BACnet IP 4 Sola
Off	Off	On	Off									BACnet IP 5 Sola
On	Off	On	Off									BACnet IP 6 Sola
Off	On	On	Off									BACnet IP 7 Sola
On	On	On	Off									BACnet IP 8 Sola
Off	Off	Off	On									BACnet MSTP 1 Sola
On	Off	Off	On									BACnet MSTP 2 Sola
Off	On	Off	On									BACnet MSTP 3 Sola
On	On	Off	On									BACnet MSTP 4 Sola
Off	Off	On	On									BACnet MSTP 5 Sola
On	Off	On	On									BACnet MSTP 6 Sola
Off	On	On	On									BACnet MSTP 7 Sola
On	On	On	On									BACnet MSTP 8 Sola
Off	Off	Off	Off	On	Off	Off	Off	Off	Off	Off	Off	Metasys N2 1 Sola
On	Off	Off	Off	On	Off	Off	Off	Off	Off	Off	Off	Metasys N2 2 Sola
Off	On	Off	Off	On	Off	Off	Off	Off	Off	Off	Off	Metasys N2 3 Sola
On	On	Off	Off	On	Off	Off	Off	Off	Off	Off	Off	Metasys N2 4 Sola
Off	Off	On	Off	On	Off	Off	Off	Off	Off	Off	Off	Metasys N2 5 Sola
On	Off	On	Off	On	Off	Off	Off	Off	Off	Off	Off	Metasys N2 6 Sola
Off	On	On	Off	On	Off	Off	Off	Off	Off	Off	Off	Metasys N2 7 Sola
On	On	On	Off	On	Off	Off	Off	Off	Off	Off	Off	Metasys N2 8 Sola

FPC-N35-103-401-0566 Dipswitch settings

ProtoCarrier Dipswitches				
S0	**S1**	**S2**	**S3**	**Profile**
Off	Off	Off	Off	Lonworks 1 Sola
On	Off	Off	Off	Lonworks 2 Sola
Off	On	Off	Off	Lonworks 3 Sola
On	On	Off	Off	Lonworks 4 Sola
Off	Off	On	Off	Lonworks 5 Sola
On	Off	On	Off	Lonworks 6 Sola
Off	On	On	Off	Lonworks 7 Sola
On	On	On	Off	Lonworks 8 Sola

1.4.2 Setting the Node/ID Device Instance (Dipswitch A0 – A7)

The DIP switches on the ProtoNode RER and LER allow users to set the Baud Rate, Node-ID and Mac address on the Field RS-485. Dip switches A0 – A7 can also be used to set the MAC Address for BACnet MSTP. This does not apply to Metasys N2.

Figure 2: A0 – A7 Dip Switches

Please refer to Appendix A for the full range of addresses.

1.4.3 Setting the Baud Rate (Dipswitch B0 –B3)

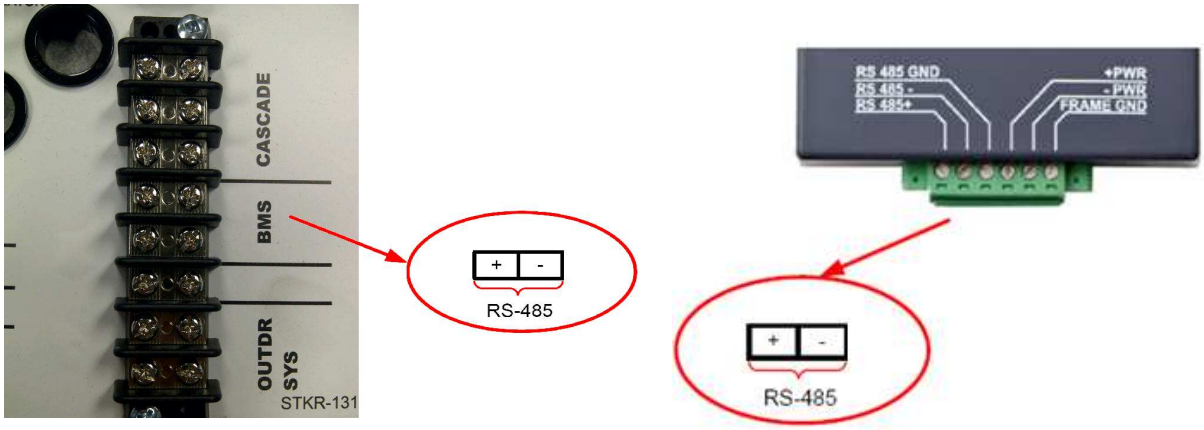
Setting the serial baud rate to match the baud rate provided by the BMS can be done through dipswitches B0 – B3. This does not apply to Metasys N2, as the baud rate is fixed at 9600 bps.

Table 1: Baud Rate Dip Switch Selection

Baud	B0	B1	B2	B3
110	Off	Off	Off	Off
300	Off	On	Off	Off
600	On	On	Off	Off
1200	Off	Off	On	Off
2400	On	Off	On	Off
4800	Off	On	On	Off
9600	On	On	On	Off
19200	Off	Off	Off	On
20833	On	Off	Off	On
28800	Off	On	Off	On
38400	On	On	Off	On
57600	Off	Off	On	On
76800	On	Off	On	On
115200	Off	On	On	On

1.5 Connection from DynaFlame/DynaForce to ProtoNode

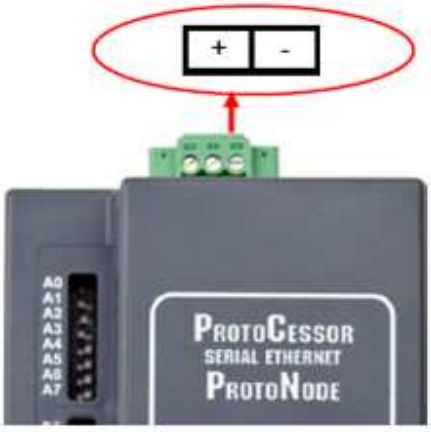
The DynaFlame/DynaForce terminals J3-MB2 (+, -, GND) are connected to the ProtoNode as shown.



1.6 Connection from ProtoNode RER to BMS

The Bacnet MSTP/ Metasys N2 system can be connected to the 3-pin connector as shown. When LonWorks is used, a 2-pin connector of the same type is used instead.

Figure 3: Connection from ProtoNode to BMS

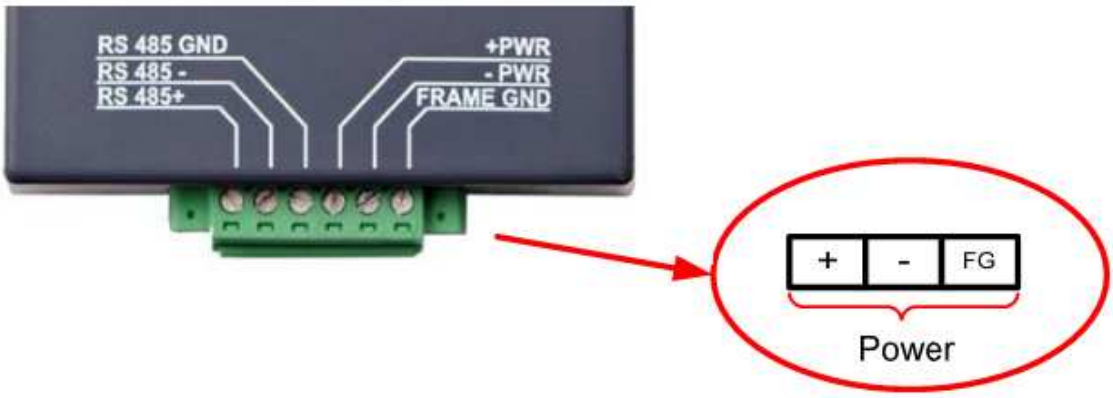


Alternatively connect Bacnet IP to the hub via the Ethernet connection when communicating with Bacnet IP. Ensure that the field device is on the same subnet as the ProtoNode. Change the ProtoNode IP address if necessary.

1.7 Power Up the Device

Apply power to the device. Ensure that the cable is grounded using the "Frame-GND" terminal. The ProtoNode is factory set for 24Vac.

Figure 4: Supply Voltage to ProtoNode

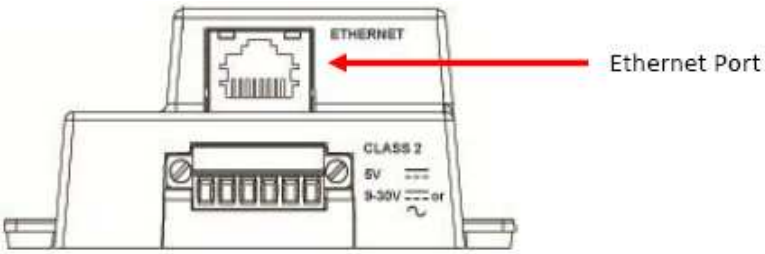


1.8 Install and Run the Utility Software

- Download the RUINET Utilities from the Protocessor web site (under Utilities section – Install.zip) www.protocessor.com/downloads/
- Run Install.zip and follow the installation instructions
- Once installed, the FieldServer Utilities can be located in the Windows Start menu as a desktop icon

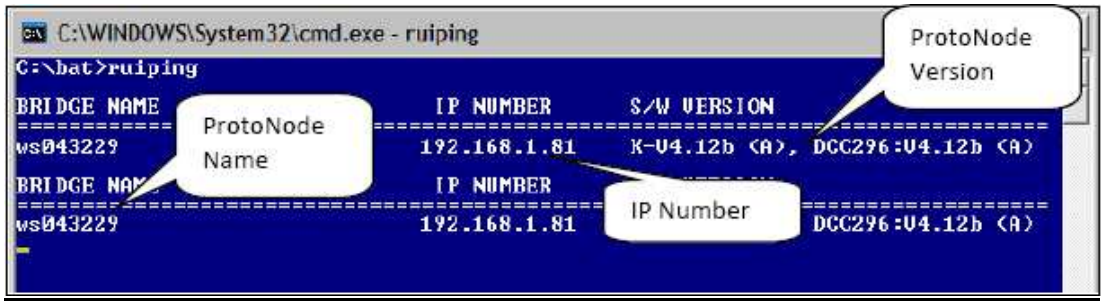
1.9 Connect the PC to the ProtoNode via the Ethernet port

Figure 5: Ethernet port location of ProtoNode



- Disable any wireless Ethernet adapters on the PC/Laptop
- Disable firewall and virus protection software
- Connect an Ethernet cross-over cable between the PC and ProtoNode and the PC to the Hub/Switch using a straight cat5 cable
- The Default IP Address of the ProtoNode is **192.168.1.24**, Subnet Mask is **255.255.255.0**. If the PC and the ProtoNode are on different IP Networks, assign a static IP Address to the PC on the 192.168.1.0 network.
- Double click on the "RUIPING" Utility. If the IP Address of the ProtoNode module appears on the screen, the ProtoNode is running.
- Go to **Start** > **Programs** > **Field Server Utilities** > **Ruiping Utility**

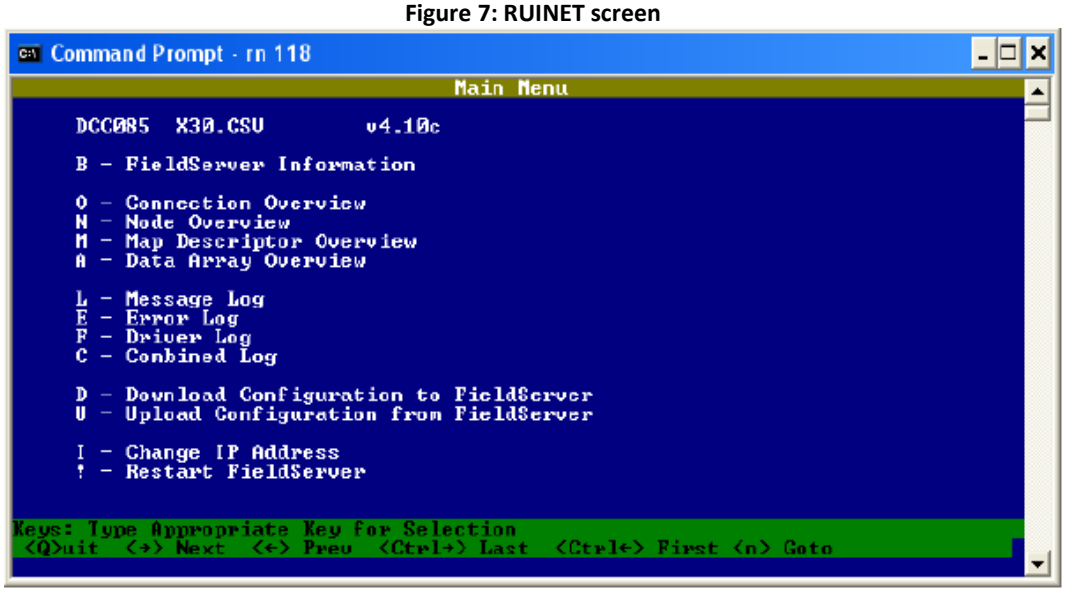
Figure 6: RUIPING screen



1.10 Connect to the ProtoNode using RUI (Ruinet)

- Double click on the debugging utility, “RUINET” (Remote User Interface). The following screen will appear: (if Ruinet does not automatically display the main menu, select the ProtoNode by typing the 2-digit number to the left of the title name).

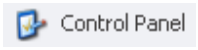
Figure 7: RUINET screen


Command Prompt - rn 118
Main Menu
DCC085 X30.CSU v4.10c
B - FieldServer Information
O - Connection Overview
N - Node Overview
M - Map Descriptor Overview
A - Data Array Overview
L - Message Log
E - Error Log
F - Driver Log
C - Combined Log
D - Download Configuration to FieldServer
U - Upload Configuration from FieldServer
I - Change IP Address
! - Restart FieldServer
Keys: Type Appropriate Key for Selection
<Q>uit <→> Next <←> Prev <Ctrl→> Last <Ctrl←> First <n> Goto

- Select “O” for Connection Overview to see the number of messages on each protocol. If the ProtoNode is communicating correctly with the device then the display will show Tx and Rx messages without any errors.
- If there are errors on the ProtoNode socket communications, edit the points list in the CSV file until there are no errors. Each time the points the points are edited, the CSV will need to be re-downloaded using Ruinet.
- When communication between the device and the ProtoNode is established the Field Side of the ProtoNode may be connected to the appropriate device/software. Ensure that the Field Side parameters on the device/software are setup as per the “ProtoNode Mapping” document.
- Read and write data from each side and make sure the ProtoNode works as expected.

1.10.1 Changing the Modbus Address

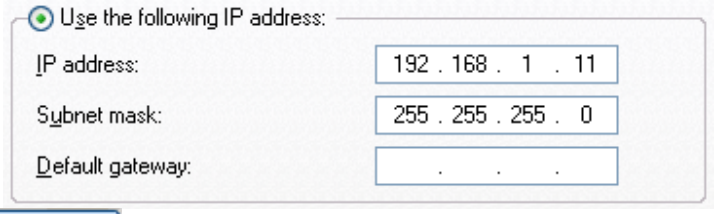
- Change the Modbus Address on the DynaFlame/DynaForce SOLA
  - Go to **[Configure]**
  - Go to **System Identification & Access**
  - Change the Modbus address to the desired setpoint and press **[OK]**
- Open up the .csv file that is available for download that is available through the Camus rep support site
  - Locate cell **Node ID** located under **Nodes** and change it to the address that specified in the Honeywell SOLA
  - Connect 24Vac to the ProtoNode
  - Connect Ethernet Cable from computer to device
  - Turn on device
  - Go to

> 

>

  - Right-click on Local Area Connection > Properties
  - Highlight

  - Select: Use the following IP address



  - Click

twice

1.10.2 Changing the IP address

From the main menu, press **"I"** to enter the Edit IP Address Settings menu

- Press **"1"** to modify the IP address of the Ethernet adapter
- Type in a new IP address in the format 192.168.2.X and press **<Enter>**
- If necessary, press **"2"** to and change the netmask

1.11 Troubleshooting Tips

Connection to the ProtoNode

- Confirm that the network cabling is correct
- Confirm that the computer network card is operational and correctly configured
- Confirm that there is an Ethernet adapter installed in the PC's Device Manager List, and that it is configured to run the TCP/IP protocol**.**
- Check that the IP netmask of the PC matches the ProtoNode. The Default IP Address of the ProtoNode is 192.168.1.24, Subnet Mask is 255.255.255.0
    - Go to **Start** > **Run**
    - Type in "ipconfig"
    - The account settings should be displayed
    - Ensure that the IP address is 192.168.1.xxx and the netmask 255.255.255.0
- Ensure that the PC and ProtoNode are on the same IP Network, or assign a Static IP Address to the PC on the 192.168.1.0 network using the Remote User Interface Utility.
- If Using Windows XP, ensure that the firewall is disabled
- Ensure that all other Ethernet cards active on the PC, especially wireless adapters are disabled
- Refer to the FieldServer Troubleshooting Guide which can be found at www/protocessor.com/downloads/ under documentation

No communication with BMS.
NOTE: If a dipswitch setting is altered, power to the Protonode must be reset

Troubleshooting steps for end-user/integrator

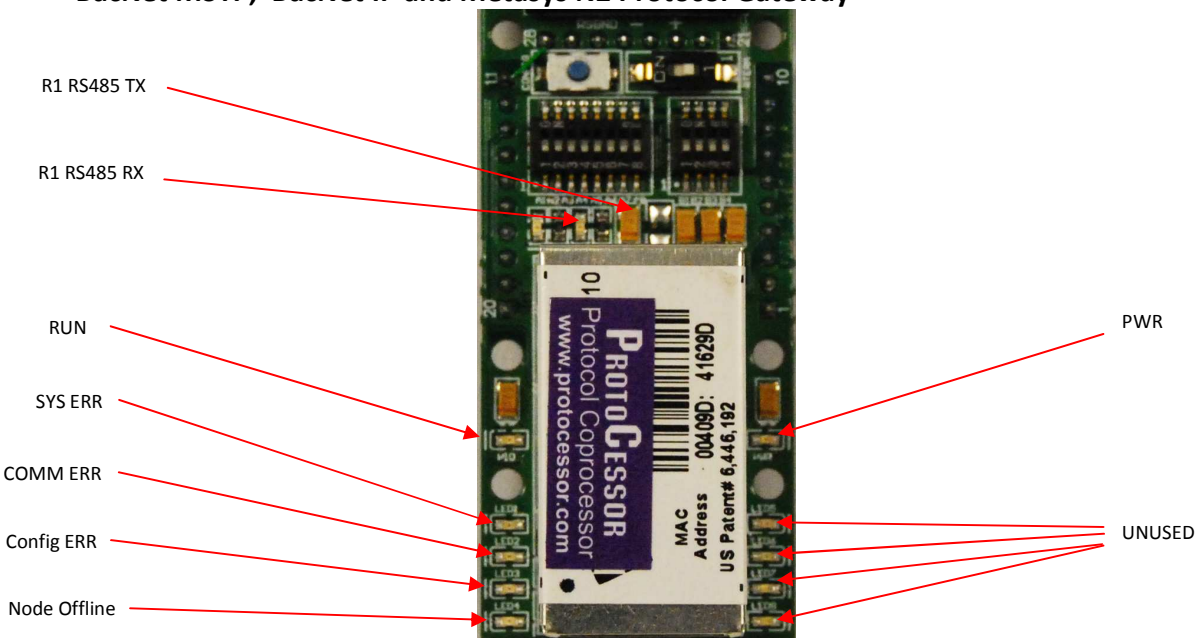
- Flip BMS/Local switch to BMS
- Verify A bank dipswitches to set the address of the ProtoNode on the Field Protocol
- Verify B bank dipswitches to set the baud rate of the ProtoNode on the Field Protocol
    - BACnet MSTP only
- Verify S bank dipswitches to select the profile
- Verify power connection to ProtoNode
    - right 3-pins of 6-pin connector on the ProtoNode
    - Check for 24 VAC
- Verify Modbus connection between ProtoNode and Sola Controller
    - left 3-pins of 6-pin connector on the ProtoNode
    - Check for 2-3Vdc signal at '+' and '-' terminals on the Protonode
    - Check for 2-3Vdc signal at '+' and '-' at J3-A (white, 13), J3-(yellow, 14) on the Sola Controller
- Verify connection to the field network
    - Ethernet connection or 3-pin RS485 connector
    - For the ethernet connection, verify the IP address settings of the ProtoNode
- If there are still issues, use FST diagnostic utility and send capture to Camus support and send a copy to Field Server to Clarke Ramilo at Clarke@fieldserver.com

1.12 ProtoNode Specifications

Table 2: ProtoNode RER/LER Specifications

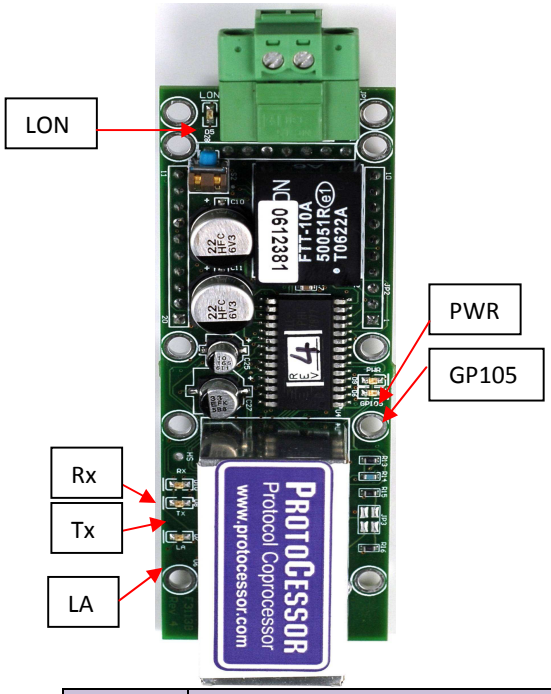
	ProtoNode RER	ProtoNode LER
Electrical Connections	One 6-pin Phoenix connector, one RS-485 +/- ground port, power +/- frame ground port One 3-pin RS-485 Phoenix connector, one RS-485 +/- ground port One Ethernet-10/100 Ethernet port	One 6-pin Phoenix connector, one RS-485 +/- ground port, power +/- frame ground port One 3-pin RS-485 Phoenix connector, one RS-485 +/- ground port One FTT-10 LonWorks port
Approvals:	Pending EN60950, UL916, FCC Class A Part 15	Pending UL60950, EN60950, UL916, CE(EN55022 and 55024) FCC Class A Part 15
Power Requirements	Multi-mode power adapter: 9-30VDC or VAC or 5VDC	
Physical Dimensions	11.5 cm L x 8.3 cm W x 4.1 cm H (4.5 x 3.2 x 1.6 in.)	
Weight:	1.3 lb	
Operating Temperature:	-40°C to 75°C (-40°F to167°F)	
Surge Suppression	Pending EN61000-4-2 ESD EN61000-4-3 EMC EN61000-4-4 EFT	
Humidity:	5 - 90% RH (non-condensing)	
(Specifications subject to change without notice)		

BacNet MSTP, BacNet IP and Metasys N2 Protocol Gateway



Light	Description
PWR	This is the power light and should show steady green at all times when the FPC-FD2 is powered.
SYS ERR	The SYS ERR LED will go on solid 15 seconds after power up. It will turn off after 5 seconds. A steady red light will indicate there is a system error on the ProtoCessor. If this occurs, immediately report the related "system error" shown in the error screen of the RUI interface to FieldServer Technologies for evaluation.
COMM ERR	COMM ERR LED will go on solid 15 seconds after power up. It will turn off after 5 seconds. A steady red light will indicate the communications problem if there is a configured node connected to the ProtoCessor that is offline. To establish the cause of the error, go to the error screen of the RUI interface.
Config ERR	Config ERR LED will go on solid 15 seconds after power up. It will turn off after 5 seconds. A steady amber light will indicate a configuration error exists in the active configuration. See the Error Screen in the Remote User Interface for a description of the configuration error.
Node Offline	Node Offline LED will go on solid 15 seconds after power up. It will turn off after 5 seconds. If the Node Offline LED stays on solid, a node offline condition has occurred.
Unused	15 seconds after powering up the 4 unused LEDs will turn on solid for 5 seconds, then turn off.
RX	On normal operation of FPC-FD2, the RX LED will flash when a message is received on the field port of the ProtoCessor.
TX	On normal operation of FPC-FD2, the TX LED will flash when a message is sent on the field port of the ProtoCessor
RUN	RUN LED will flash 20 seconds after power up, signifying normal operation. The FPC-FD2 will be able to access RUINET once this LED starts flashing. During the first 20 seconds, the LED should be off

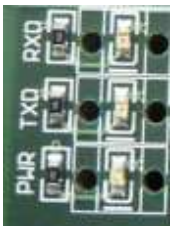
LonWorks Protocol Gateway



Light	Description
PWR	This is the power light and should show steady green at all times when the FFP-F04 is powered.
LA-PIC A	Starts flashing about once per second to indicate that the PIC in the ProtoCessor has powered up successfully
GP105	Will go on solid within 45 – 60 seconds after power up, signifying normal operation. The ProtoCessor will be able to access RUINET shortly after this LED comes on. During the first 45-60 seconds the LED should be dark.
Upon successful operation of **GP105 t**he ProtoCessor will go through diagnostics of the field port communications.	
RX	On normal operation of FFP-F04, the RX LED will flash when a message is received on the LON port of the ProtoCessor.
TX	On normal operation of FFP-F04,, the TX LED will flash when a message is sent on the LON port of the ProtoCessor
LON	When the unit is first powered up, before commissioning has occurred, this LED will flash. Once the unit is commissioned, the LED will stay off during normal operation

RS-485 Signal LEDs

The RS-485 Signal LEDS are each labeled and correspond to the respective data lines sent from the ProtoCessor. The following signals are provided. RS-485 TX and RS-485 RX.



2.1 Modbus

The DynaFlame/DynaForce is equipped with a standard ICP Modbus port through a 3-pin connector that interfaces to the following RS-485 signals:

Table 3: Connection Terminals

Signal	Terminal
Data + (a)	1
Data – (b)	2

Serial transmission mode on the Modbus network is RTU mode. Message format has the following characteristics:

Table 4: DynaFlame/DynaForce SOLA Data Transmission Specifications

Coding system	8-bit binary
Number of data bits per character	10
	1 Start bit
	8 data bits, no parity bit
	1 stop bit
Bit transfer rate	38400 bps
Duplex	Half Duplex
Error Checking	2 byte CRC-16 polynomial
Bit transfer order	LSB first
End of message	Idle line for 3.5 or more characters

2.2 Bacnet, Modbus and Metasys N2 Registers

Table 5: Modbus and Bacnet IP/MSTP Register Addresses

Parameter Name	Modbus Address (hex)	Modbus Register (dec)	Bacnet/ N2 Data Type	Bacnet/ N2 Object ID	LonWorks Object ID	Read/Write	Note
Limits	0004	0004	AI/AI	1	0	R	15-12 Reserved (always 0) 11 = Heat exchanger high limit 10 = Exchanger T-rise limit 9 = Outlet T-rise limit 8 = Inversion inlet/exchanger limit 7 = Inversion exchanger/outlet limit 6 = Inversion inlet/outlet limit 5 = Delta T inlet/exchanger limit 4 = Delta T exchanger/outlet limit 3 = Delta T inlet/outlet limit 2 = Stack limit 1 = DHW high limit 0 = Outlet high limit
Demand Source	0006	0006	AI/AI	2	1	R	0 = Unknown 1 = No source demand 2 = CH 3 = DHW 4 = Lead Lag slave 5 = Lead lag master 6 = CH frost protection 7 = DHW frost protection 8 = No demand due to burner switch turned off 9 = DHW storage 10 = Reserved

							11 = Warm weather shutdown
Outlet Sensor	0007	0007	AI/AI	3	2	R	-40 – 130°C (0.1°C precision)[1]
Firing Rate	0008	0008	AI/AI	4	0	R	Actual Fire Rate (%[2] or RPM[3])
Fan Speed	0009	0009	AI/AI	5	4	R	RPM
Flame Signal	0010	0010	AI/AI	6	5	R	0.01V (0.00 – 50.00V)
Inlet Sensor	000B	0011	AI/AI	7	6	R	-40 – 130°C (0.1°C precision)[1]
DHW Sensor	000C	0012	AI/AI	8	7	R	-40 – 130°C (0.1°C precision)[1]
S5 Sensor	000D	0013	AI/AI	9	8	R	-40 – 130°C (0.1°C precision)[1]
Stack Sensor	000E	0014	AI/AI	10	9	R	-40 – 130°C (0.1°C precision)[1]
4-20mA remote control input	000F	0015	AI/AI	11	10	R	4-20mA (0.1mA precision)
Active CH Setpoint	0010	0016	AI/AI	12	11	R	-40 – 130°C (0.1°C precision)[1] Setpoint determined by CH Setpoint source
Active DHW Setpoint	0011	0017	AI/AI	13	12	R	
Active Lead Lag (LL) Setpoint	0012	0018	AI/AI	14	13	R	
Analog modulation input	0015	0021	AI/AI	15	14	R	0 = No signal, otherwise 4-20mA (0.1mA precision). Duplicate of register (hex) 0015.
Burner Control Status	0020	0032	AI/AI	16	15	R	0 = Disabled 1 = Locked Out 2-3 = Reserved 4 = Anti-short cycle 5 = Unconfigured safety data 6-33 = Reserved 34 = Standby hold

							35 = Standby delay 36-47 = Reserved 48 = Normal standby 49 = Preparing 50 = Ignition 51 = Firing 52 = Postpurge 53-65535 = Reserved
Lockout Code	0022	0034	AI/AI	17	16	R	0 = No lockout 1 – 4096 (See Table 4)
Alarm Reason	0023	0035	AI/AI	18	17	R	0 = None 1 = Lockout, see register (hex) 0015 for lockout code 2 = Alert (See Table 6)
Annunciator first out	0024	0036	AI/AI	19	18	R	0 = None 1 = ILK 12 = Flow Switch 13 = High Limit 14 = Gas Pressure Switch 15 = Air Switch
Annunciator hold	0025	0037	AI/AI	20	19	R	0 = None 1 = ILK 3 = LCI 12 = Flow Switch 13 = High Limit 14 = Gas Pressure Switch
Hold code	0028	0040	AI/AI	21	20	R	Reason for burner hold (See Table 4)
Remote Stat	002A	0042	AI/AI	22	21	R/W	Reserved for future use
CH Status	0040	0064	AI/AI	23	22	R	0 = Unknown

							1 = Disabled 2 = Normal 3 = Suspended
CH Setpoint Source	0041	0065	AI/AI	24	23	R	0 = Unknown 1 = Normal Setpoint 2 = Time of Day Setpoint 3 = Outdoor reset 4 = Remote control 7 = Outdoor reset time of day
CH Heat Demand	0042	0066	AI/AI	25	24	R	0 = Off 1 = On
CH Burner Demand	0043	0067	AI/AI	26	25	R	0 =Off 1 = On
CH Requested Rate	0044	0068	AI/AI	27	26	R	RPM or %[3]
DHW Status	0050	0080	AI/AI	28	27	R	0 = Unknown 1 = Disabled 2 = Normal 3 = Suspended
DHW Heat Demand	0053	0083	AI/AI	29	28	R	0 = Off 1 = On
DHW Burner Demand	0054	0084	AI/AI	30	29	R	0 = Off 1 = On
DHW Requested Rate	0055	0085	AI/AI	31	30	R	RPM or %[3]

Pump A Status	005D	0093	AI/AI	32	31	R	**Bitmap** 15 – 14 = Reserved 13 = Auxiliary 2 pump demand 12 = Auxiliary 1 pump demand 11 = System pump demand 10 = Boiler pump demand 9 = DHW pump demand 8 = CH pump demand **Reason** 7 = Reserved 6 = Pump assigned to logical pump 5 = Pump exercise requested 4 = Pump on due to exercise 3 = Pump on due to Post pump 2 = Forced off 1 = Forced on 0 = On due to normal demand
Pump B Status	005E	0094	AI/AI	33	32	R	
CH pump status	0060	0096	AI/AI	34	33	R	Application Build < 1600 Application Build > 1600
DHW pump status	0064	0100	AI/AI	35	34	R	
System pump status	0069	0105	AI/AI	36	35	R	
Boiler Pump Status	006C	0108	AI/AI	37	36	R	
Burner Cycle Count	0080-0081	0128-0129	AV/AO	89		R/W	0-999,999
Burner Run Time	0082-0083	0130-0131	AV/AO	90		R/W	0-999,999 hours
CH Pump	0084-0085	0132-0133	AV/AO	91	3	R/W	0-999,999

Cycle Count							
DHW Pump Cycle Count	0086-0087	0134-0135	AV/AO	92	4	R/W	0-999,999
System Pump Cycle Count	0088-0089	0136-0137	AV/AO	93	5	R/W	0-999,999
Boiler Pump Cycle Count	008A-008B	0138-0139	AV/AO	94	5	R/W	0-999,999
Controller Run Time	0090-0091	0144-0145	AI/AI	95	7	R	0-999,999 hours
Lead Lag Master Status	00A0	0160	AI/AI	38	37	R	0 = Unknown 1 = Disabled 2 = Normal 3 = Suspended
Lead Lag Slave Status	00A1	0161	AI/AI	39	38	R	**Bitmap** 15 = Slave command received 14 = Slave mode has priority over CH & DHW 13 = Slave is modulating 12 = CH frost protection request 11 = DHW frost protection request 10 = Frost protection burner request 9 = Local frost protection request 8 = Reserved (always 0) 7-0 = Burner control status see register (hex) 32
Pump C Status	00A8	0168	AI/AI	40	39	R	**Bitmap** 15 – 14 = Reserved 13 = Auxiliary 2 pump demand 12 = Auxiliary 1 pump demand

							11 = System pump demand 10 = Boiler pump demand 9 = DHW pump demand 8 = CH pump demand **Reason** 7 = Reserved 6 = Pump assigned to logical pump 5 = Pump exercise requested 4 = Pump on due to exercise 3 = Pump on due to Post pump 2 = Forced off 1 = Forced on 0 = On due to normal demand
Outdoor Temperature	00AA	0170	AI/AI	41	40	R	-40 – 130°C (0.1°C precision)[1]
Operating System (OS) Number	00BA	0186	AI/AI	42		R	Variable length string (up to 16 characters)
Date Code	00BB	0187	AI/AI	43		R	Variable length string (up to 10 characters)
Safety processor build	00BC	0188	AI/AI	44		R	
Application processor build	00BD	0189	AI/AI	45		R	
Installer Password	00BE	0190	AV/AO	46	45	W	Password: sola
Burner Switch	00CB	0203	AV/AO	47	46	R/W	Used to enable/disable burner control 0 = Off

							1 = On
CH Enable	00D0	0208	AV/AO	48		R/W	0 = Disable Central Heating 1 = Enable Central Heating
CH Setpoint	00D3	0211	AV/AO	49	48	R/W	-40 – 130°C (0.1°C precision)[1]
CH Time of Day Setpoint	00D4	0212	AV/AO	50	49	R/W	-40 – 130°C (0.1°C precision)[1]. Reserved for future use
CH Outdoor Reset Enable	00D7	0215	AV/AO	51	50	R/W	0 = Disable outdoor reset 1 = Enable outdoor reset
Prepurge Time	00E7	0231	AV/AO	52		R/W	SAFETY PARAMETER 0-64800 seconds (18 hours)
Postpurge Time	00EC	0236	AV/AO	53		R/W	SAFETY PARAMETER 0-64800 seconds (18 hours)
DHW Demand Switch	01C1	0449	AV/AO	54	53	R/W	0 = DHW Disabled 1 = DHW Enabled
DHW Setpoint	01C5	0453	AV/AO	55	54	R/W	-40 – 130°C (0.1°C precision)[1]
Outlet High Limit Setpoint	01D0	0464	AV/AO	56		R/W	SAFETY PARAMETER -40 – 130°C (0.1°C precision)[1]
CH Outdoor Max Outdoor Temperature	0200	0512	AV/AO	58	57	R/W	-40 – 130°C (0.1°C precision)[1]
CH Outdoor Min Water Temperature	0201	0513	AV/AO	59	58	R/W	-40 – 130°C (0.1°C precision)[1]
CH Frost Protection Enable	0210	0528	AV/AO	60		R/W	0 = Disable 1 = Enable

DHW Frost Protection Enable	0211	0529	AV/AO	61		R/W	0 = Disable 1 = Enable
Outdoor Frost Protection Setpoint	0212	0530	AV/AO	62		R/W	-40 – 130°C (0.1°C precision)[1]
Lead Lag Slave Enable	0220	0544	AV/AO	63		R/W	0 = Lead/Lag slave disabled 1 = Lead/lag simple slave enabled for EnviraCom Master 2 = Lead/lag simple slave enabled for Global Modbus master 3= Lead/lead full slave enabled for Global Modbus master
Lead Lag Master Enable	0221	0545	AV/AO	64		R/W	0 = Not a lead/Lag master 1 = Lead/Lag master
Lead Lag Setpoint	0222	0546	AV/AO	65		R/W	-40 – 130°C (0.1°C precision)[1]
Lead Lag Modulation Sensor	022E	0558	AV/AO	66	65	R/W	Sensor used for Lead Lag modulation: 0 = S5 sensor 1 = S10 sensor
Lead Lag CH Modbus Setpoint	0232	0562	AV/AO	67		R/W	-40 – 130°C (0.1°C precision)[1]

Slave Command	0235	0565	AV/AO	98(Boiler Firing Rate using percentage), 99 (Boiler Firing Rate using Binary), 100 (Boiler Enable)		R/W	**Bitmap** 15 = Slave demand request 14 = Slave suspend startup 13 = Slave run fan request 12 = Turn on auxiliary pump X 11 = Turn on auxiliary pump Y 10 = Turn on auxiliary pump Z 9 = Slave pump demand 8 = Commanded rate is binary fraction %[5] 7-0 = Commanded rate[4]
CH Modbus Setpoint	0243	0579	AV/AO	68		R/W	-40 – 130°C (0.1°C precision)[1]
CH Modulation Rate Source	0244	0580	AV/AP	69	68	R/W	0 = Local modulation (sensor)
CH Modbus Rate	0245	0581	AI/AI	96		R	Commanded CH modulation rate[4] when source is Modbus
Warm Weather Shutdown Setpoint	0274	0628	AV/AO	71	70	R/W	-40 – 130°C (0.1°C precision)[1]
Lead Lag DHW Setpoint	02C1	0705	AV/AO	72	71	R/W	-40 – 130°C (0.1°C precision)[1]
Slave 1 State	0302	0770	AI/AI	73	72	R	Slave State: 0 = Slave is unknown 1 = Available 2 = Add Stage 3 = Suspended Stage
Slave 2 State	0306	0774	AI/AI	75	74	R	
Slave 3 State	030A	0778	AI/AI	77	76	R	
Slave 4 State	030E	0782	AI/AI	79	78	R	
Slave 5 State	0312	0786	AI/AI	81	80	R	

Slave 6 State	0316	0790	AI/AI	83	82	R	4 = Firing 5 = On leave 6 = Disabled 7 = Recovering
Slave 7 State	031A	0794	AI/AI	85	84	R	
Slave 8 State	031E	0798	AI/AI	87	86	R	
Slave 1 Firing Rate	0304	0772	AI/AI	74		R	Current firing rate (0-100%)
Slave 2 Firing Rate	0308	0776	AI/AI	76		R	
Slave 3 Firing Rate	030C	0780	AI/AI	78		R	
Slave 4 Firing Rate	0310	0784	AI/AI	80		R	
Slave 5 Firing Rate	0314	0788	AI/AI	82		R	
Slave 6 Firing Rate	0318	0792	AI/AI	84		R	
Slave 7 Firing Rate	031C	0796	AI/AI	86		R	
Slave 8 Firing Rate	0320	0800	AI/AI	88		R	
Lead Boiler Address	0321	0801	AI/AI	97	103	R	Modbus address of the first boiler that will be or was added to service Lead Lag demand (slave must be available for firing)
Lead Lag Operation Switch	022B	0555	BV/DO	104	105	R/W	To enable/disable the Lead Lag boiler plant

[1] All temperature registers are expressed in °C regardless of what temperature units are set to on the boiler, ex. 32.0°C = 320. A temperature that is NOT applicable has a value of 0x8FFF.
[2] All percentage values are given in 0.1% granularity, ie. 0-1000 is the range from 0.0 – 100.0%
[3] Most significant bit in value determines which units type the parameter has: 0 = RPM, 1 = %. If modulation output parameter doesn't match with the setting of this bit, then the parameter setting is invalid
[4] For binary fraction % format commanded rate is a binary fraction between .00000000 (0% = no heat at all) and .11111111 (99.98% = maximum fire). For a 0.5% step format commanded rate is a value between 0 (minimum fire) and 200 (maximum fire) that is a multiple of 0.5% (200 x 0.5% = 100%)
[5] Commanded rate in least significant byte of this register can be expressed in two formats: binary fraction % or multiple of 035% steps. Bit 8 of this register indicates which format the commanded rate is expressed in; when bit 8 is set, the commanded rate is in binary fraction % format when bit 8 is cleared, the commanded rate is in 0.5% steps.

2.3 Lockout Codes

Table 6: Lockout Codes

Code	Description	Note
0	None	No lockout/hold
1	Unconfigured safety data	Lockout
2	Waiting for safety data verification	Lockout
3	Internal fault: Hardware fault	Hold
4	Internal fault: Safety relay feedback error	Hold
5	Internal fault: Unstable power (DCDC) output	Hold
6	Internal fault: Invalid processor clock	Hold
7	Internal fault: Safety relay drive error	Hold
8	Internal fault: Zero crossing not detected	Hold
9	Internal fault: Flame bias out of range	Hold
10	Internal fault: Invalid burner control state	Lockout
11	Internal fault: Invalid burner control state flag	Lockout
12	Internal fault: Safety relay drive cap short	Hold
13	Internal fault: PII shorted to ILK	Hold/Lockout
14	Internal fault: HFS shorted to LCI	Hold/Lockout
15	Internal fault: Safety relay test failed due to feedback ON	Lockout
16	Internal fault: Safety relay test failed due to safety relay OFF	Lockout
17	Internal fault: Safety relay test failed due to safety relay not OFF	Lockout
18	Internal fault: Safety relay test failed due to feedback not ON	Lockout
19	Internal fault: Safety RAM write	Lockout
20	Internal fault: Flame ripple and overflow	Hold
21	Internal fault: Flame number of sample mismatch	Hold
22	Internal fault: Flame bias out of range	Hold
23	Internal fault: Bias changed since heating cycle starts	Hold
24	Internal fault: Spark voltage stuck low or high	Hold
25	Internal fault: Spark voltage changed too much during flame sensing time	Hold
26	Internal fault: Static flame ripple	Hold
27	Internal fault: Flame rod shorted to ground detected	Hold
28	Internal fault: A/D linearity test failed	Hold
29	Internal fault: Flame bias cannot be set in range	Hold
30	Internal fault: Flame bias shorted to adjacent pin	Hold
31	Internal fault: SLO electronics unknown error	Hold
32	Internal fault: Safety key 0	Lockout
33	Internal fault: Safety key 1	Lockout
34	Internal fault: Safety key 2	Lockout
35	Internal fault: Safety key 3	Lockout
36	Internal fault: Safety key 4	Lockout
37	Internal fault: Safety key 5	Lockout

38	Internal fault: Safety key 6	Lockout
39	Internal fault: Safety key 7	Lockout
40	Internal fault: Safety key 8	Lockout
41	Internal fault: Safety key 9	Lockout
42	Internal fault: Safety key 10	Lockout
43	Internal fault: Safety key 11	Lockout
44	Internal fault: Safety key 12	Lockout
45	Internal fault: Safety key 13	Lockout
46	Internal fault: Safety key 14	Lockout
47	Flame rod to ground leakage	Hold
48	Static flame (not flickering)	Hold
49	24Vac voltage low/high	Hold
50	Modulation fault	Hold
51	Pump fault	Hold
52	Motor tachometer fault	Hold
53	AC inputs phase reversed	Lockout
54	Safety GVT model ID doesn't match application's model ID	Lockout
55	Application configuration data block CRC errors	Lockout
56-57	RESERVED	
58	Internal fault: HFS shorted to IAS	Lockout
59	Internal fault: Mux pin shorted	Lockout
60	Internal fault: HFS shorted to LFS	Lockout
61	Anti-short cycle	Hold
62	Fan speed not proved	Hold
63	LCI off	Hold
67	ILK off	Hold
68	ILK on	Hold
69	Pilot test hold	Hold
70	Wait for leakage test completion	Hold
71-77	RESERVED	
78	Demand lost in run	Hold
79	Outlet high limit	Hold
81	Delta T inlet/outlet limit	Hold
82	Stack limit	Lockout
91	Inlet sensor fault	Hold
92	Outlet sensor fault	Hold
93	DHW sensor fault	Hold
94	S2 (J8-6) sensor fault	Hold
95	Stack sensor fault	Hold
96	S5 (J8-11) sensor fault	Hold
97	Internal fault: A2D mismatch	Lockout
98	Internal fault: Exceeded VSNSR voltage tolerance	Lockout
99	Internal fault: Exceeded 28V voltage tolerance	Lockout
101-104	RESERVED	

105	Flame detected out of sequence	Lockout
106	Flame lost in MFEP	Lockout
107	Flame lost early in run	Lockout
108	Flame lost in run	Lockout
109	Ignition failed	Lockout
110	Ignition failure occurred	Hold
111	Flame current lower than WEAK threshold	Hold
112	Pilot test flame timeout	Lockout
113	Flame circuit timeout	Lockout
114-121	RESERVED	
122	Lightoff rate proving failed	Lockout
123	Purge rate proving failed	Lockout
124	High fire switch OFF	Hold
125	High fire switch stuck ON	Hold
126	Low fire switch OFF	Hold
127	Low fire switch stuck ON	Hold
128	Fan speed failed during prepurge	Hold
129	Fan speed failed during preignition	Hold
130	Fan speed failed during ignition	Hold
131	Fan movement detected during standby	Hold
132	Fan speed failed during run	Hold
133-135	RESERVED	
136	Interrupted Airflow Switch failed to close	Hold
137	ILK failed to close	Hold
138-142	RESERVED	
143	Internal fault: Flame bias out of range 1	Lockout
144	Internal fault: Flame bias out of range 2	Lockout
145	Internal fault: Flame bias out of range 3	Lockout
146	Internal fault: Flame bias out of range 4	Lockout
147	Internal fault: Flame bias out of range 5	Lockout
148	Internal fault: Flame bias out of range 6	Lockout
149	Flame detected	Lockout
150	Flame not detected	Hold
151	High fire switch ON	Hold
158	Main valve ON	Lockout
159	Main valve OFF	Lockout
160	Ignition ON	Lockout
161	Ignition OFF	Lockout
162	Pilot valve ON	Lockout
163	Pilot valve OFF	Lockout
166-171	RESERVED	
172	Main relay feedback incorrect	Lockout
173	Pilot relay feedback incorrect	Lockout
174	Safety relay feedback incorrect	Lockout

175	Safety relay open	Lockout
176	Main relay ON and safe start check	Lockout
177	Pilot relay ON at safe start check	Lockout
178	Safety relay ON at safe start check	Lockout
179-183	RESERVED	
184	Invalid Blower/HIS output setting	Lockout
185	Invalid Delta T limit enable setting	Lockout
186	Invalid Delta T limit response setting	Lockout
187	Invalid DHW high limit enable setting	Lockout
188	Invalid DHW high limit response setting	Lockout
189	Invalid Flame sensor type setting	Lockout
192	Invalid igniter on during setting	Lockout
193	Invalid ignite failure delay setting	Lockout
194	Invalid ignite failure response setting	Lockout
195	Invalid ignite failure retries setting	Lockout
196	Invalid ignition source setting	Lockout
197	Invalid interlock open response setting	Lockout
198	Invalid Interlock start check setting	Lockout
199	Invalid LCI enable setting	Lockout
200	Invalid lightoff rate setting	Lockout
201	Invalid lightoff rate proving setting	Lockout
202	Invalid Main Flame Establishing Period setting	Lockout
203	Invalid MFEP flame failure response setting	Lockout
204	Invalid NTC sensor type setting	Lockout
205	Invalid Outlet high limit response setting	Lockout
206	Invalid Pilot Flame Establishing Period setting	Lockout
207	Invalid PII enable setting	Lockout
208	Invalid pilot test hold setting	Lockout
209	Invalid pilot type setting	Lockout
210	Invalid postpurge time setting	Lockout
211	Invalid power up with lockout setting	Lockout
212	Invalid preignition time setting	Lockout
213	Invalid prepurge rate setting	Lockout
214	Invalid prepurge time setting	Lockout
215	Invalid purge rate proving setting	Lockout
216	Invalid run flame failure response setting	Lockout
217	Invalid run stabilization time setting	Lockout
218	Invalid stack limit enable setting	Lockout
219	Invalid stack limit enable setting	Lockout
224	Invalid DHW demand source setting	Lockout
225	Invalid flame threshold setting	Lockout
226	Invalid outlet high limit setpoint setting	Lockout
228	Invalid Stack limit setpoint setting	Lockout
229	Invalid modulation output setting	Lockout

230	Invalid CH demand source setting	Lockout
231	Invalid Delta T limit delay setting	Lockout
234	Invalid outlet high limit enable setting	Lockout
235	Invalid outlet connector type setting	Lockout
236	Invalid inlet connector type setting	Lockout
237	Invalid DHW connector type setting	Lockout
238	Invalid Stack connector type setting	Lockout
239	Invalid S2 (J8-6) connector type setting	Lockout
240	Invalid S5 (J8-11) connector type setting	Lockout
244	Internal fault: Safety relay test invalid state	Lockout
246	4-20mA cannot be used for both modulation and setpoint control	Lockout
250	Invalid fan speed error message	Lockout
252-255	RESERVED	

2.4 PII, LCI, ILK Terminal Configuration

Table 7: PII, LCI, ILK Terminal Configuration

Byte Offset	Parameter	Read/Write	Format
0-2	Interlock short name	R/W	U8
3	Unused	--	U8
4-23	Interlock name	R/W	U8

2.5 SOLA Alert Codes

Table 8: SOLA Alert Codes

Code	Description
0	None (No alert)
1	Alert PCB was restored from factory defaults
2	Safety configuration parameters were restored from factory defaults
3	Configuration parameters were restored from factory defaults
4	Invalid Factory Invisibility PCB was detected
5	Invalid Factory Range PCB was detected
6	Invalid range PCB record has been dropped
7	EEPROM lockout history was initialized
8	Switched application annunciation data blocks
9	Switched application configuration data blocks
10	Configuration was restored from factory defaults
11	Backup configuration settings was restored from active configuration
12	Annunciation configuration was restored from factory defaults
13	Annunciation configuration was restored from backup
14	Safety group verification table was restored from factory defaults
15	Safety group verification table was updated
16	Invalid Parameter PCB was detected
17	Invalid Range PCB was detected
18	Alarm silence time exceeded maximum
19	Invalid safety group verification table was detected
20	Backdoor password could not be determined

21	Invalid safety group verification table was not accepted
22	CRC errors were found in application configuration data blocks
23	Backup Alert PCB was restored from active one
24	RESERVED
25	Lead Lag operation switch was turned OFF
26	Lead Lag operation switch was turned ON
27	Safety processor was reset
28	Application processor was reset
29	Burner switch was turned OFF
30	Burner switch was turned ON
31	Program Module (PM) was inserted into socket
32	Program Module (PM) was removed from socket
33	Alert PCB was configured
34	Parameter PCB was configured
35	Range PCB was configured
36	Program Module (PM) incompatible with product was inserted into socket
37	Program Module application parameter revision differs from application processor
38	Program Module safety parameter revision differs from safety processor
39	PCB incompatible with product contained in Program Module
40	Parameter PCB in Program Module is too large for product
41	Range PCB in Program Module was too large for product
42	Alert PCB in Program Module was too large for product
43	IAS start check was forced on due to IAS enabled
44	Low voltage was detected in safety processor
45	High line frequency occurred
46	Low line frequency occurred
47	Invalid subsystem reset request occurred
48	Write large enumerated Modbus register value was not allowed
49	Maximum cycle count was reached
50	Maximum hours count was reached
51	Illegal Modbus write was attempted
52	Modbus write attempt was rejected (NOT ALLOWED)
53	Illegal Modbus read was attempted
54	Safety processor brown-out reset occurred
55	Application processor watchdog reset occurred
56	Application processor brown-out reset occurred
57	Safety processor watchdog reset occurred
58	Alarm was reset by the user at the control
59	Burner control firing rate was > absolute max rate
60	Burner control firing rate was < absolute min rate
61	Burner control firing rate was invalid, % vs. RPM
62	Burner control was firing with no fan request
63	Burner control rate (nonfiring) was > absolute max rate
64	Burner control rate (nonfiring) was < absolute min rate
65	Burner control rate (nonfiring) was absent
66	Burner control rate (nonfiring) was invalid, % vs. RPM
67	Fan off cycle rate was invalid, % vs. RPM
68	Setpoint was overridden due to sensor fault
69	Modulation was overridden due to sensor fault

70	No demand source was set due to demand priority conflicts
71	CH 4-20mA signal was invalid
72-	RESERVED
74	Periodic Forced Recycle
75	Absolute max fan speed was out of range
76	Absolute min fan speed was out of range
77	Fan gain down was invalid
78	Fan gain up was invalid
79	Fan minimum duty cycle was invalid
80	Fan pulses per revolution was invalid
81	Fan PWM frequency was invalid
82-	RESERVED
84	Lead Lag CH 4-20mA water temperature setting was invalid
85	No Lead Lag add stage error threshold was configured
86	No Lead Lag add stage detection time was configured
87	No Lead Lag drop stage error threshold was configured
88	No Lead Lag drop stage detection time was configured
89	Lead Lag all boiler off threshold was invalid
90	Modulation output type was invalid
91	Firing rate control parameter was invalid
92	Forced rate was out of range vs. min/max modulation
93	Forced rate was invalid, % vs. RPM
94	Slow start ramp value was invalid
95	Slow start degrees value was invalid
96	Slow start was ended due to outlet sensor fault
97	Slow start was end due to reference setpoint fault
98	CH max modulation rate was invalid, % vs. RPM
99	CH max modulation rate was > absolute max rate
100	CH modulation range (max minus min) was too small (< 4% or 40 RPM)
101	DHW max modulation rate was invalid, % vs. RPM
102	DHW max modulation rate was > absolute max rate
103	DHW modulation range (max minus min) was too small (< 4% or 40 RPM)
104	Min modulation rate was < absolute min rate
105	Min modulation rate was invalid, % vs. RPM
106	Manual rate was invalid, % vs. RPM
107	Slow start enabled, but forced rate was invalid
108	Analog output hysteresis was invalid
109	Analog modulation output type was invalid
110	IAS open rate differential was invalid
111	IAS open step rate was invalid
112	Mix max modulation rate was invalid, % vs. RPM
113	Mix max modulation rate was > absolute max or < absolute min rates
114	Mix modulation range (max minus min) was too small (< 4% or 40 RPM)
115	Fan was limited to its minimum duty cycle
116	Manual rate was > CH max modulation rate
117	Manual rate was > DHW max modulation rate
118	Manual rate was < min modulation rate
119	Manual rate in Standby was > absolute max rate
120	Modulation commanded rate was > CH max modulation rate
121	Modulation commanded rate was > DHW max modulation rate

122	Modulation commanded rate was < min modulation rate
123	Modulation rate was limited due to Outlet limit
124	Modulation rate was limited due to Delta-T limit
125	Modulation rate was limited due to Stack limit
126	Modulation rate was limited due to anticondensation
127	Fan speed out of range in RUN
128	Modulation rate was limited due to IAS was open
129	Slow start ramp setting of zero will result in no modulation rate change
130	No forced rate was configured for slow start ramp
131	CH demand source was invalid
132	CH P-gain was invalid
133	CH I-gain was invalid
134	CH D-gain was invalid
135	CH OFF hysteresis was invalid
136	CH ON hysteresis was invalid
137	CH sensor type was invalid
138	CH hysteresis step time was invalid
139	CH remote control parameter was invalid
140	CH ODR not allowed with remote control
141	Steam P-gain was invalid
142	Steam I-gain was invalid
143	Steam D-gain was invalid
144	Steam OFF hysteresis was invalid
145	Steam ON hysteresis was invalid
146	CH control was suspended due to fault
147	CH header temperature was invalid
148	CH Outlet temperature was invalid
149	CH steam pressure was invalid
150	Steam setpoint source parameter was invalid
151	Minimum water temperature parameter was greater than setpoint
152	Minimum water temperature parameter was greater than time of day setpoint
153	Minimum pressure parameter was greater than setpoint
154	Minimum pressure parameter was greater than time of day setpoint
155	CH modulation rate source parameter was invalid
156	Steam modulation rate source parameter was invalid
157	DHW demand source was invalid
158	DHW P-gain was invalid
159	DHW I-gain was invalid
160	DHW D-gain was invalid
161	DHW OFF hysteresis was invalid
162	DHW ON hysteresis was invalid
163	DHW hysteresis step time was invalid
164	DHW sensor type was invalid
165	Inlet sensor type was invalid for DHW
166	Outlet sensor type was invalid for DHW
167	DHW storage OFF hysteresis was invalid
168	DHW storage ON hysteresis was invalid
169	DHW modulation sensor type was invalid
170	DHW modulation sensor was not compatible for Auto mode
171	DHW control was suspended due to fault

172	DHW temperature was invalid
173	DHW inlet temperature was invalid
174	DHW outlet temperature was invalid
175	DHW high limit must be disabled for Auto mode
176	DHW sensor type was not compatible for Auto mode
177	DHW priority source setting was invalid
178	DHW priority method setting was invalid
179	CH S5 (J8-11) sensor was invalid
180	CH Inlet temperature was invalid
181	CH S10 (J10-7) sensor was invalid
182	Lead Lag CH setpoint source was invalid
183	Lead Lag P-gain was invalid
184	Lead Lag I-gain was invalid
185	Lead Lag D-gain was invalid
186	Lead Lag OFF hysteresis was invalid
187	Lead Lag ON hysteresis was invalid
188	Lead Lag slave enable was invalid
189	Lead Lag hysteresis step time was invalid
190	No Lead Lag Modbus port was assigned
191	Lead Lag base load common setting was invalid
192	Lead Lag DHW demand switch setting was invalid
193	Lead Lag Mix demand switch setting was invalid
194	Lead Lag modulation sensor setting was invalid
195	Lead Lag backup modulation sensor setting was invalid
196	Lead Lag slave mode setting was invalid
197	Lead Lag rate allocation setting was invalid
198	Lead selection setting was invalid
199	Lag selection setting was invalid
200	Lead Lag slave return setting was invalid
201	Lead Lag add stage method setting was invalid
202	STAT may not be a Lead Lag CH demand source when Remote Stat is enabled
203	Lead Lag base load rate setting was invalid
204	Lead Lag master was suspended due to fault
205	Lead Lag slave was suspended due to fault
206	Lead Lag header temperature was invalid
207	Lead Lag was suspended due to no enabled Program Module installed
208	Lead Lag slave session has timed out
209	Too many Lead Lag slaves were detected
210	Lead Lag slave was discovered
211	Incompatible Lead Lag slave was discovered
212	No base load rate was set for Lead Lag slave
213	Lead Lag slave unable to fire before demand to fire delay expired
214	Adding Lead Lag slave aborted due to add requirement change
215	No Lead Lag slaves available to service demand
216	No Lead Lag active service was set due to demand priority conflicts
217	No Lead Lag add stage method was specified
218	No Lead Lag drop stage method was specified
219	Using backup Lead Lag header sensor due to sensor failure
220	Lead Lag frost protection rate was invalid
221	Lead Lag drop stage method setting was invalid

222	CH frost protection temperature was invalid
223	CH frost protection inlet temperature was invalid
224	DHW frost protection temperature was invalid
225-226	RESERVED
227	DHW priority override time was not derated due to invalid outdoor temperature
228	Warm weather shutdown was not checked due to invalid outdoor temperature
229	Lead Lag slave communication timeout
230	RESERVED
231	Lead Lag CH setpoint was invalid
232	Lead Lag CH time of day setpoint was invalid
233	Lead Lag outdoor temperature was invalid
234	Lead Lag ODR time of day setpoint was invalid
235	Lead Lag ODR time of day setpoint exceeded normal setpoint
236	Lead Lag ODR max outdoor temperature was invalid
237	Lead Lag ODR min outdoor temperature was invalid
238	Lead Lag ODR low water temperature was invalid
239	Lead Lag ODR outdoor temperature range was too small (minimum 12 C / 22
240	Lead Lag ODR water temperature range was too small (minimum 12 C / 22 F)
241	Lead Lag DHW setpoint was invalid
242	Lead Lag Mix setpoint was invalid
243	Lead Lag CH demand switch was invalid
244	Lead Lag ODR min water temperature was invalid
245	RESERVED
246	CH setpoint was invalid
247	CH time of day setpoint was invalid
248	CH outdoor temperature was invalid
249	CH ODR time of day setpoint was invalid
250	CH ODR time of day setpoint exceeds normal setpoint
251	CH max outdoor setpoint was invalid
252	CH min outdoor setpoint was invalid
253	CH ODR low water temperature was invalid
254	CH ODR outdoor temperature range was too small
255	CH ODR water temperature range was too small
256	Steam setpoint was invalid
257	Steam time of day setpoint was invalid
258	Steam minimum pressure was invalid
259	CH ODR min water temperature was invalid
260	RESERVED
261	DHW setpoint was invalid
262	DHW time of day setpoint was invalid
263	DHW storage setpoint was invalid
264	STAT may not be a DHW demand source when Remote Stat is enabled
265-266	RESERVED
267	STAT may not be a CH demand source when Remote Stat is enabled
268	CH 4mA water temperature setting was invalid
269	CH 20mA water temperature setting was invalid
270	Steam 4mA water temperature setting was invalid
271	Steam 20mA water temperature setting was invalid
272	Abnormal Recycle: Pressure sensor fault
273	Abnormal Recycle: Safety relay drive test failed

274	Abnormal Recycle: Demand off during Pilot Flame Establishing Period
275	Abnormal Recycle: LCI off during Drive to Purge Rate
276	Abnormal Recycle: LCI off during Measured Purge Time
277	Abnormal Recycle: LCI off during Drive to Lightoff Rate
278	Abnormal Recycle: LCI off during Pre-Ignition test
279	Abnormal Recycle: LCI off during Pre-Ignition time
280	Abnormal Recycle: LCI off during Main Flame Establishing Period
281	Abnormal Recycle: LCI off during Ignition period
282	Abnormal Recycle: Demand off during Drive to Purge Rate
283	Abnormal Recycle: Demand off during Measured Purge Time
284	Abnormal Recycle: Demand off during Drive to Lightoff Rate
285	Abnormal Recycle: Demand off during Pre-Ignition test
286	Abnormal Recycle: Demand off during Pre-Ignition time
287	Abnormal Recycle: Flame was on during Safe Start check
288	Abnormal Recycle: Flame was on during Drive to Purge Rate
289	Abnormal Recycle: Flame was on during Measured Purge Time
290	Abnormal Recycle: Flame was on during Drive to Lightoff Rate
291	Abnormal Recycle: Flame was not on at end of Ignition period
292	Abnormal Recycle: Flame was lost during Main Flame Establishing Period
293	Abnormal Recycle: Flame was lost early in Run
294	Abnormal Recycle: Flame was lost during Run
295	Abnormal Recycle: Leakage test failed
296	Abnormal Recycle: Interrupted air flow switch was off during Drive to Purge
297	Abnormal Recycle: Interrupted air flow switch was off during Measured Purge
298	Abnormal Recycle: Interrupted air flow switch was off during Drive to Lightoff
299	Abnormal Recycle: Interrupted air flow switch was off during Pre-Ignition test
300	Abnormal Recycle: Interrupted air flow switch was off during Pre-Ignition time
301	Abnormal Recycle: Interrupted air flow switch was off during Main Flame
302	Abnormal Recycle: Ignition failed due to interrupted air flow switch was off
303	Abnormal Recycle: ILK off during Drive to Purge Rate
304	Abnormal Recycle: ILK off during Measured Purge Time
305	Abnormal Recycle: ILK off during Drive to Lightoff Rate
306	Abnormal Recycle: ILK off during Pre-Ignition test
307	Abnormal Recycle: ILK off during Pre-Ignition time
308	Abnormal Recycle: ILK off during Main Flame Establishing Period
309	Abnormal Recycle: ILK off during Ignition period
310	Run was terminated due to ILK was off
311	Run was terminated due to interrupted air flow switch was off
312	Stuck reset switch
313	Run was terminated due to fan failure
314	Abnormal Recycle: Fan failed during Drive to Purge Rate
315	Abnormal Recycle: Fan failed during Measured Purge Time
316	Abnormal Recycle: Fan failed during Drive to Lightoff Rate
317	Abnormal Recycle: Fan failed during Pre-Ignition test
318	Abnormal Recycle: Fan failed during Pre-Ignition time
319	Abnormal Recycle: Fan failed during Ignition period
320	Abnormal Recycle: Fan failed during Main Flame Establishing Period
321	Abnormal Recycle: Main Valve off after 10 seconds of RUN
322	Abnormal Recycle: Pilot Valve off after 10 seconds of RUN
323	Abnormal Recycle: Safety Relay off after 10 seconds of RUN

324	Abnormal Recycle: Hardware flame bias
325	Abnormal Recycle: Hardware static flame
326	Abnormal Recycle: Hardware flame current invalid
327	Abnormal Recycle: Hardware flame rod short
328	Abnormal Recycle: Hardware invalid power
329	Abnormal Recycle: Hardware invalid AC line
330	Abnormal Recycle: Hardware SLO flame ripple
331	Abnormal Recycle: Hardware SLO flame sample
332	Abnormal Recycle: Hardware SLO flame bias range
333	Abnormal Recycle: Hardware SLO flame bias heat
334	Abnormal Recycle: Hardware SLO spark stuck
335	Abnormal Recycle: Hardware SLO spark changed
336	Abnormal Recycle: Hardware SLO static flame
337	Abnormal Recycle: Hardware SLO rod shorted
338	Abnormal Recycle: Hardware SLO AD linearity
339	Abnormal Recycle: Hardware SLO bias not set
340	Abnormal Recycle: Hardware SLO bias shorted
341	Abnormal Recycle: Hardware SLO electronics
342	Abnormal Recycle: Hardware processor clock
343	Abnormal Recycle: Hardware AC phase
344	Abnormal Recycle: Hardware A2D mismatch
345	Abnormal Recycle: Hardware VSNSR A2D
346	Abnormal Recycle: Hardware 28V A2D
347	Abnormal Recycle: Hardware HFS IAS shorted
348	Abnormal Recycle: Hardware PII INTLK shorted
349	Abnormal Recycle: Hardware HFS LCI shorted
350	Abnormal Recycle: Hardware HFS LFS shorted
351	Abnormal Recycle: Invalid zero crossing
352	Abnormal Recycle: fault stack sensor
353	Abnormal Recycle: stack limit
354	Abnormal Recycle: delta T limit
355	Abnormal Recycle: fault outlet sensor
356	Abnormal Recycle: outlet high limit
357	Abnormal Recycle: fault DHW sensor
358	Abnormal Recycle: DHW high limit
359	Abnormal Recycle: fault inlet sensor
360	Abnormal Recycle: Check Parameters Failed
361	Internal error: No factory parameters were detected in control
362	Internal error: PID iteration frequency was invalid
363	Internal error: Demand-Rate interval time was invalid
364	Internal error: Factory calibration parameter for modulation was invalid
365	Internal error: CH PID P-scaler was invalid
366	Internal error: CH PID I-scaler was invalid
367	Internal error: CH PID D-scaler was invalid
368	Internal error: DHW PID P-scaler was invalid
369	Internal error: DHW PID I-scaler was invalid
370	Internal error: DHW PID D-scaler was invalid
371	Internal error: Lead Lag master PID P-scaler was invalid
372	Internal error: Lead Lag master PID I-scaler was invalid
373	Internal error: Lead Lag master PID D-scaler was invalid

374	Abnormal Recycle: Hardware flame bias high
375	Abnormal Recycle: Hardware flame bias low
376	Abnormal Recycle: Hardware flame bias delta high
377	Abnormal Recycle: Hardware flame bias delta low
378	Abnormal Recycle: Hardware flame bias dynamic high
379	Abnormal Recycle: Hardware flame bias dynamic low
380	Abnormal Recycle: Fan Speed Not Proven
381	Abnormal Recycle: Fan Speed Range Low
382	Abnormal Recycle: Fan Speed Range High
383-450	RESERVED
451	Circulator control was invalid
452	Circulator P-gain was invalid
453	Circulator I-gain was invalid
454	Circulator temperature was invalid
455	Circulator outlet temperature was invalid
456	Circulator inlet temperature was invalid
457	Circulator outdoor temperature was invalid
458	Circulator sensor choice was invalid
459	Circulator PID setpoint was invalid
460	LCI lost in run
461	Abnormal Recycle: Demand lost in run from application
462	Abnormal Recycle: Demand lost in run due to high limit
463	Abnormal Recycle: Demand lost in run due to no flame
464	LCI lost in Combustion Pressure Establishing Period
465	LCI lost in Combustion Pressure Stabilization Period
466	RESERVED
467	Internal error: EEPROM write was attempted before EEPROM was initialized
468	Internal error: EEPROM cycle count address was invalid
469	Internal error: EEPROM days count address was invalid
470	Internal error: EEPROM hours count address was invalid
471	Internal error: Lockout record EEPROM index was invalid
472	Internal error: Request to write PM status was invalid
473	Internal error: PM parameter address was invalid
474	Internal error: PM safety parameter address was invalid
475	Internal error: Invalid record in lockout history was removed
476	Internal error: EEPROM write buffer was full
477	Internal error: Data too large was not written to EEPROM
478	Internal error: Safety key bit 0 was incorrect
479	Internal error: Safety key bit 1 was incorrect
480	Internal error: Safety key bit 2 was incorrect
481	Internal error: Safety key bit 3 was incorrect
482	Internal error: Safety key bit 4 was incorrect
483	Internal error: Safety key bit 5 was incorrect
484	Internal error: Safety key bit 6 was incorrect
485	Internal error: Safety key bit 7 was incorrect
486	Internal error: Safety key bit 8 was incorrect
487	Internal error: Safety key bit 9 was incorrect
488	Internal error: Safety key bit 10 was incorrect
489	Internal error: Safety key bit 11 was incorrect
490	Internal error: Safety key bit 12 was incorrect

491	Internal error: Safety key bit 13 was incorrect
492	Internal error: Safety key bit 14 was incorrect
493	Internal error: Safety key bit 15 was incorrect
494	Internal error: Safety relay timeout
495	Internal error: Safety relay commanded off
496	Internal error: Unknown safety error occurred
497	Internal error: Safety timer was corrupt
498	Internal error: Safety timer was expired
499	Internal error: Safety timings
500	Internal error: Safety shutdown
501	RESERVED
502	Mix setpoint was invalid
503	Mix time of day setpoint was invalid
504	Mix outdoor temperature was invalid
505	Mix ODR time of day setpoint was invalid
506	Mix ODR time of day setpoint exceeds normal setpoint
507	Mix ODR max outdoor temperature was invalid
508	Mix ODR min outdoor temperature was invalid
509	Mix ODR low water temperature was invalid
510	Mix ODR outdoor temperature range was invalid
511	Mix ODR water temperature range was invalid
512	Mix demand switch was invalid
513	Mix ON hysteresis was invalid
514	Mix OFF hysteresis was invalid
515	Mix ODR min water temperature was invalid
516	Mix hysteresis step time was invalid
517	Mix P-gain was invalid
518	Mix I-gain was invalid
519	Mix D-gain was invalid
520	Mix control was suspended due to fault
521	Mix S10 (J10-7) temperature was invalid
522	Mix outlet temperature was invalid
523	Mix inlet temperature was invalid
524	Mix S5 (J8-11) temperature was invalid
525	Mix modulation sensor type was invalid
526	Mix ODR min water temperature setpoint was invalid
527	Mix circulator sensor was invalid
528	Mix flow control was invalid
529	Mix temperature was invalid
530	Mix sensor was invalid
531	Mix PID setpoint was invalid
532	STAT may not be a Mix demand source when Remote Stat is enabled
533-539	RESERVED
540	Delta T inlet/outlet enable was invalid
541	Delta T exchanger/outlet enable was invalid
542	Delta T inlet/exchanger enable was invalid
543	Delta T inlet/outlet degrees was out of range
545	Delta T inlet/exchanger degrees was out of range
546	Delta T response was invalid
547	Delta T inversion limit response was invalid

548	Delta T rate limit enable was invalid
549	Delta T exchanger/outlet wasn't allowed due to stack limit setting
550	Delta T inlet/outlet limit was exceeded
551	Delta T exchanger/outlet limit was exceeded
552	Delta T inlet/exchanger limit was exceeded
553	Inlet/outlet inversion occurred
554	Exchanger/outlet inversion occurred
555	Inlet/exchanger inversion occurred
556	Delta T exchanger/outlet wasn't allowed due to stack connector setting
557	Delta T inlet/exchanger wasn't allowed due to stack limit setting
558	Delta T inlet/exchanger wasn't allowed due to stack connector setting
559	Delta T delay was not configured for recycle response
560	Outlet T-rise enable was invalid
561	Heat exchanger T-rise enable was invalid
562	T-rise degrees was out of range
563	T-rise response was invalid
564	Outlet T-rise limit was exceeded
565	Heat exchanger T-rise limit was exceeded
566	Heat exchanger T-rise wasn't allowed due to stack limit setting
567	Heat exchanger T-rise wasn't allowed due to stack connector setting
568	Outlet T-rise wasn't allowed due to outlet connector setting
569	T-rise delay was not configured for recycle response
570	Heat exchanger high limit setpoint was out of range
571	Heat exchanger high limit response was invalid
572	Heat exchanger high limit was exceeded
573	Heat exchanger high limit wasn't allowed due to stack limit setting
574	Heat exchanger high limit wasn't allowed due to stack connector setting
575	Heat exchanger high limit delay was not configured for recycle response
576	CH pump output was invalid
577	DHW pump output was invalid
578	Boiler pump output was invalid
579	Auxiliary pump output was invalid
580	System pump output was invalid
581	Mix pump output was invalid
582-589	RESERVED
590	DHW plate preheat setpoint was invalid
591	DHW plate preheat ON hysteresis was invalid
592	DHW plate preheat OFF hysteresis was invalid
593	Tap detect degrees was out of range
594	Tap detect ON hysteresis was invalid
595	Inlet - DHW tap stop degrees was out of range
596	Outlet - Inlet tap stop degrees was out of range
597	DHW tap detect on threshold was invalid
598	DHW plate preheat detect on threshold was invalid
599	DHW plate preheat detect off threshold was invalid
600	Delta T inlet temperature was invalid
601	Delta T outlet temperature was invalid
602	Delta T exchanger temperature was invalid
603	Parameter PCB was switched to backup
604	Range PCB was switched to backup

Appendix A

A7	A6	A5	A4	A3	A2	A1	A0	Address
Off	Off	Off	Off	Off	Off	Off	Off	0
Off	Off	Off	Off	Off	Off	Off	On	1
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Off	Off	Off	Off	Off	Off	On	On	3
Off	Off	Off	Off	Off	On	Off	Off	4
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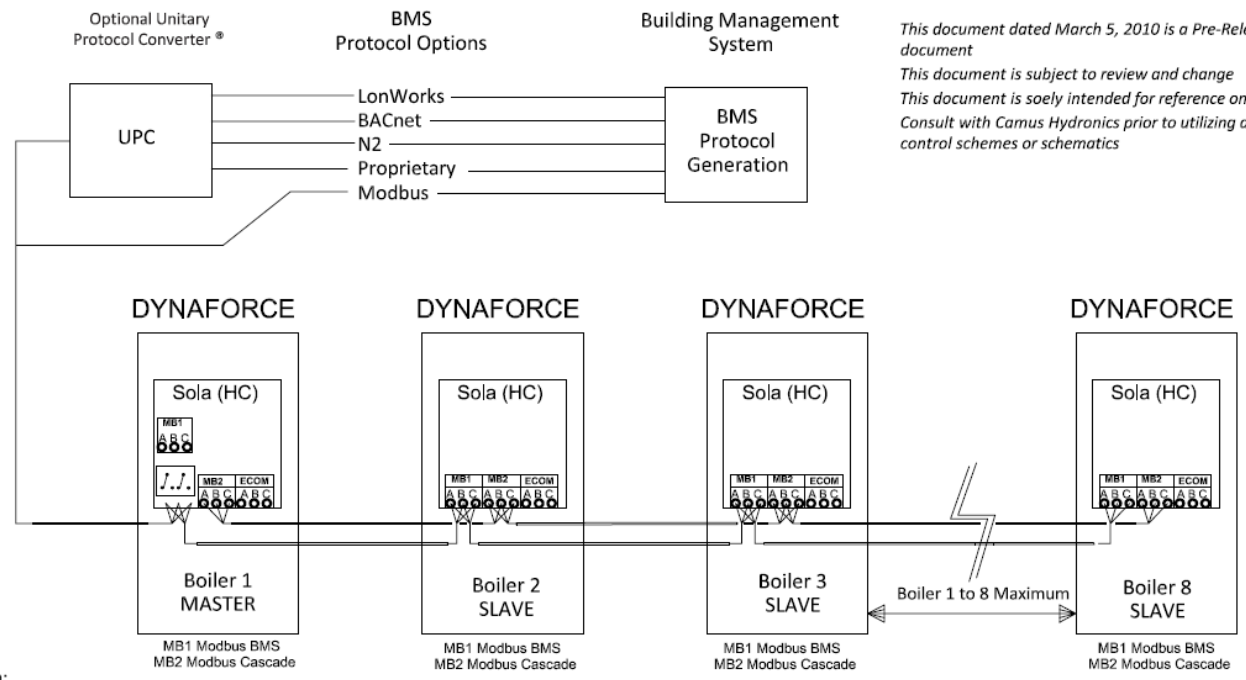
CAMUS Hydronics Ltd.

#8 BUILDING MANAGEMENT SYSTEM CONTROL - ONE to EIGHT BOILERS



This document dated March 5, 2010 is a Pre-Release document
This document is subject to review and change
This document is soely intended for reference only
Consult with Camus Hydronics prior to utilizing any control schemes or schematics

Operation:

Control up to 8 boilers - Modbus protocol
Multi-Signal conversion of Building Management System (BMS) protocol to Modbus by optional Unitary Protocol Converter ® (attached)
Access to all boiler configurations from multiple boiler protocol source interfaces
Establish full Sola control interface configurations for parameter settings and control operation
Limited parameter access per Camus factory SOLA programming
Establish a back up boiler to boiler Modbus interface for Sola master / slave lead lag operation control
Establish boiler base and modulation Control Algorithm operation
Establish inlet or remote target temperature set point, remote tank, system, or outdoor reset control
Optional Boiler Remote / Local Modbus interruption for emergency, service, or offline boiler operation

WARNING;
This drawing shows suggested control and interface configuration.

DRAWN MSB	Mar. 5 2010	CAMUS HYDRONICS LIMITED
CHECKED		TITLE: DynaForce - Control Interface # 8 BMS 8 Boilers Cascade Lead Lag Multiple Protocol
QA		
MFG		
This drawing is the property of Camus Hydronics Limited. This drawing may not be used/copied without Camus's prior written consent.		SIZE A; DWG NO None; REV 00; SCALE; SHEET 1 OF 1